on networks™
Easy, Reliable & Secure

Powerline PL500 Series Adapter

User Manual

Models:

PL500
PL500P

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Support

Thank you for selecting On Networks products. On Networks recommends that you use only the official On Networks support resources.

After installing your device, locate the serial number on the label of your product and use it to register your product at *www.on-networks.com/register*. You must register your product before you can use On Networks telephone support. On Networks recommends registering your product through the On Networks website. For product updates and web support, visit *support.on-networks.com*.

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1 Getting Started

This chapter describes your Powerline adapter and how it fits into a home network. It also explains the security features and how to secure your Powerline network with a private encryption key.

This chapter includes:

- *Hardware Features*
- *How the Powerline Adapter Fits into Your Network*
- *Set Up a New Powerline Network*
- *Powerline Network Security*
- *Use the Security Button to Set the Encryption Key*

Hardware Features

This section describes the hardware features of the Powerline Adapters. Adapters vary by region. Your adapter might look different.

Powerline 500 Home Network Adapter (PL500)

The hardware features are shown in the following figure.

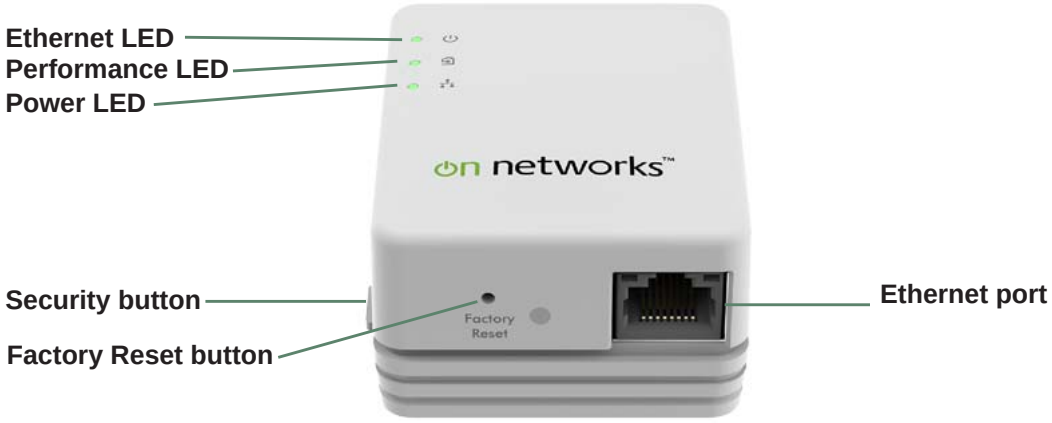

Figure 1. PL500 hardware features

Powerline 500 Plus Home Network Adapter (PL500P)

The hardware features of the PL500P are shown in the following figure.

Figure 2. PL500P hardware features

LED Descriptions

The LEDs indicate the status of your Powerline adapter.

Table 1. LEDs

LED	Description
Ethernet	• **Solid green**. The Ethernet port is linked. • **Off**. No powered-on device is connected to the Ethernet port.
Performance	• **Solid green**. Link rate > 80 Mbps (fast). • **Solid amber**. Link rate > 50 Mbps and < 80 Mbps (medium). • **Solid red**. Link rate < 50 Mbps (slow). • **Off**. The adapter has not found any other compatible Powerline devices that are using the same encryption key.
Power	• **Solid green**. The electrical power is on. • **Solid amber**. The adapter is in power saving mode. • **Blinking green**. The adapter is in the process of setting up security. • **Off**. The Powerline adapter is not receiving electrical power.

Button Descriptions

The buttons on your Powerline adapter let you do the following:

- **Factory Reset button**. Use the Factory Reset button to return your Powerline adapter to its factory default settings. Press the **Factory Reset** button for two seconds and then release it.
- **Security button**. Once the Powerline adapters are active, you can use the Security button to secure your Powerline network with a private encryption key. See *Use the Security Button to Set the Encryption Key* on page 10.

Ethernet Port

You need to use the Ethernet port on one Powerline adapter to connect it to the router or gateway for your network. For other Powerline adapters in your network, you can connect a device with an Ethernet port, such as a computer, game console, Blu-ray player, smart TV, HD set-top box, or network DVR.

PL500P Pass-Through Socket

The filtered pass-through socket can remove some electrical noise that might affect Powerline performance. Plugging the power plugs of nearby devices into the filtered pass-through socket improves performance.

Product Label

The product label shows details specific to your Powerline adapter, including the following information.

- Model number
- MAC address
- Serial number
- Device password

How the Powerline Adapter Fits into Your Network

Powerline adapters can extend Internet access throughout your home. You need at least two compatible Powerline adapters to form a Powerline network.

- The first Powerline adapter connects to your router with an Ethernet cable so that the Powerline network is linked to your local area network (LAN).
- The other Powerline adapters use electrical power lines to form a Powerline network that includes the first Powerline adapter.

When the Powerline network is working, you can connect a computer or device to a Powerline adapter, and share the Internet connection.

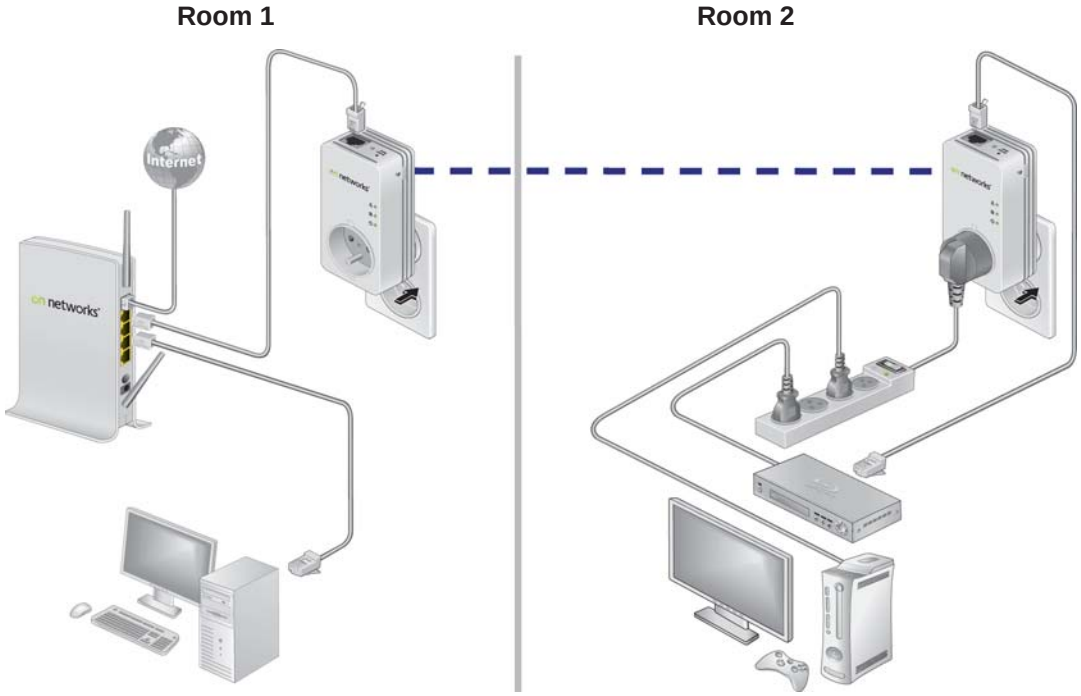

Figure 3. A Powerline network with two Powerline adapters

For best performance, plan the location of your Powerline adapters.

- To avoid accidentally turning off the power to the outlet, select an electrical outlet that is not controlled by a wall switch.
- Do not plug Powerline adapters into electrical outlets that are located near appliances that consume a lot of power, such as washers, dryers, or refrigerators. Interference from these appliances might prevent Powerline products from working correctly or reduce Powerline network performance.
- Do not plug Powerline adapters into a power strip, extension cord, or surge protector. Connecting a Powerline adapter to one of these devices might prevent it from working correctly or reduce Powerline network performance.

Set Up a New Powerline Network

Different Powerline models can share the Powerline network. All On Networks Powerline AV products are compatible.

➢ **To set up a new Powerline network:**

1. Make sure that your network is working and that you can connect to the Internet.
2. Plug a Powerline adapter into an electrical outlet near your router or gateway.
3. Use an Ethernet cable to connect the adapter to a LAN port on your router or gateway.

4. Plug the second Powerline adapter into an electrical outlet where you want to add Internet access.

5. Use the provided Ethernet cable to connect a computer, game console, Blu-ray player, or other device to the Ethernet port on the Powerline adapter.

   The Powerline adapters attempt to detect each other and form a Powerline network.

6. Wait for the Powerline network to recognize each Powerline adapter.

   This process could take as little as 5 seconds or up to 80 seconds.

   When the process is complete, the Power and Performance LEDs stop blinking. A red Performance LED indicates a slow link rate. In this case, move the Powerline adapter to another electrical outlet with a faster connection.

7. Secure your Powerline network as explained in *Use the Security Button to Set the Encryption Key* on page 10.

Add a Powerline Adapter to a Powerline Network

If you already have a Powerline network, make sure that one of the Powerline adapters is connected to your router or gateway, and that your new Powerline adapter is compatible.

➢ **To add a Powerline adapter to a Powerline network:**

1. If you used the Security button to secure your Powerline network, press the **Factory Reset** button for two seconds on each Powerline adapter to return it to its factory default settings.

   This method is the quickest way to allow the Powerline adapter to communicate with the other Powerline devices.

2. Plug the Powerline adapter into an electrical outlet where you want to add Internet access.

   The Powerline adapters attempt to detect each other and form a Powerline network.

3. Wait for the Powerline network to recognize each Powerline adapter.
   - This process could take as little as 5 seconds or up to 80 seconds.
   - When the Power and Performance LEDs stop blinking, the process is complete.
   - If the Performance LED is green or amber, the adapter is connected to the Powerline network. A red Performance LED indicates a slow link rate. In this case, move the Powerline adapter to another electrical outlet with a faster connection.
4. (Optional) Use the provided Ethernet cable to connect a computer, game console, Blu-ray player, or other device to the Ethernet port on the Powerline adapter.
5. Secure your Powerline network as explained in *Use the Security Button to Set the Encryption Key* on page 10.

Powerline Network Security

For better security, you can customize the Powerline network encryption for the Powerline network. Security is especially important if your network is located in a building in which others share the same electrical system as you. If your Powerline network is in a shared building such as an apartment complex, neighbors with Powerline networks could potentially use their connection to gain access to your network and Internet connection.

The default encryption key is HomePlugAV. You can use the Security button on the Powerline adapter to change it to a random private encryption key. See the following section, *Use the Security Button to Set the Encryption Key* .

Use the Security Button to Set the Encryption Key

You can use the Security button to set a random private encryption key instead of using the default encryption key HomePlugAV. The Powerline adapters retain security settings even if they are unplugged.

A Powerline adapter can only generate a private encryption key when it has its factory default settings. Pressing the Security button to generate a random key only works once. If you press the Security button again after that, the adapter does not generate another random key (unless you reset the adapter). Instead, the adapter sends a signal that indicates it is available to assign the key to another adapter. This process works for two adapters at a time. If you have more than two Powerline adapters on your network, set up the encryption key for the first two, and then set it for the remaining Powerline adapters.

➢ **To set the encryption key for the first two Powerline adapters:**

1. For both Powerline adapters, press the **Factory Reset** button for two seconds, then release it.

   Each Powerline adapter returns to its factory settings.
2. Plug in both Powerline adapters.
3. Verify that the Power and Performance LEDs on both Powerline adapters are lit solid green or amber.

CAUTION:

Do not press the Security button until the Power and Performance LEDs for both adapters are lit solid. Pressing the Security button too soon can temporarily disable Powerline communication.

If Powerline communication is disabled, reset the Powerline adapter to its factory default settings. (Press the **Factory Reset** button for two seconds, then release it).

4. Press the **Security** button on the first Powerline adapter for two seconds.
   - The Power LED blinks after you release the button.
   - The Powerline adapter generates a random encryption key that all other Powerline devices on the network must use.

   At this point, the Powerline adapters cannot communicate with each other.
5. Within two minutes, press the **Security** button on the second Powerline adapter for two seconds.

   - The Power LED blinks after you release the button.
   - This process allows the second Powerline adapter to use the same private encryption key as the first so that they can communicate.

   When the Power LEDs stop blinking and the Performance LEDs are lit solid green or amber, the two adapters can communicate over the Powerline network in a secure way.

➢ **To set the encryption key for more Powerline adapters:**

1. Plug in the next Powerline adapter.

   It cannot communicate with the first and second Powerline adapters yet because it is using a different encryption key.

2. On the first Powerline adapter, press the **Security** button.
3. Within two minutes, press the **Security** button on the Powerline adapter that you are setting up.

   The Powerline adapters detect each other and synchronize using the random encryption key.

Now, all three Powerline adapters use the same random encryption key to communicate.

2 Troubleshooting

This chapter provides information to help you diagnose and solve problems that you might encounter.

This chapter includes:

- *Basic Functioning*
- *Troubleshooting Tips*

Basic Functioning

After you plug in the Powerline device, the following sequence of events should occur:

1. The Power LED lights.
2. After approximately 10 seconds, verify the following:
   - The Power LED is lit solid green. The device is powered on.
   - If the device is connected to a Powerline network, the Performance LED is lit.
   - If the Powerline device is connected through the Ethernet port to a powered-on Ethernet device, the Ethernet LED is lit.

Troubleshooting Tips

The adapter has Factory Reset and Security buttons.

- Pressing the Factory Reset button longer than 2 seconds does not reset the device.
- Pressing the Security button longer than 2 seconds does not activate security.

LEDs

The LEDs indicate activity and can be used for troubleshooting.

Power LED

- **Off**. The Powerline adapter is not receiving electrical power.
  - Make sure that power is supplied to the electrical outlet and the Powerline adapter is not plugged into an extension cord, power strip, or surge protector.
  - Press the **Factory Reset** button on the Powerline device for 2 seconds to return the device to its factory default settings.
- **Amber**. Power saving mode occurs when the Ethernet link is inactive. The Ethernet link is inactive when:
  - The Ethernet cable is unplugged.
  - The peripheral device that is connected through the Ethernet port is turned off.
  - The Powerline device is idle for 10 minutes.

  The Powerline device returns to normal mode within 2 seconds once the Ethernet link is active. Power saving mode is disabled by default.

Performance LED

- **Off**. The Powerline adapters cannot find each other. Make sure that the Powerline adapters are plugged into wall outlets with power and that they use the same network encryption key.

  - Move the Powerline adapter to an outlet that is closer to the computer or devices.
  - If you set a private encryption key, make sure that all Powerline devices are using the same encryption key.
  - If the problem occurred after you set the encryption key, reset each device to its factory default settings. Then try setting the encryption key again.
- **Amber or red**. Move the Powerline adapter to another electrical outlet with a faster connection.

Ethernet LED Is Off

The Powerline adapter does not detect an Ethernet connection.

- If your Powerline adapter is connected to the LAN port of your router, make sure that:
  - Your router and modem are turned on.
  - The computer connected directly to the router can access the Internet.
- If your Powerline adapter is connected to a computer, game console, Blu-ray player, or other device, make sure that:
  - The device is turned on.
  - The Powerline adapter is securely connected to the device with an Ethernet cable.
- Press the **Factory Reset** button on each Powerline adapter for 2 seconds to return the device to its factory default settings.

Supplemental Information

A

This appendix provides technical specifications and safety information for Powerline PL500 Series Adapters.

This appendix includes the following sections:

- *PL500 Technical Specifications*
- *PL500P Technical Specifications*
- *Safety Information*

PL500 Technical Specifications

The PL500 meets the technical specifications defined in the following table.

Table 1. PL500 specifications

Feature	Specification
Data and routing protocols	IEEE 802.3 (10BASE-T), IEEE 802.3u (100BASE-Tx)
AC input	100–240V, 0.2A (max.)
Power consumption	Normal: 4W, power saving mode: <0.5W
Dimensions	114 x 55 x 33 mm each (4.49 x 2.17 x 1.3 in)
Weight	160 g (5.64 oz)
Operating temperature	0° to 40°C (32º to 104ºF)
Operating humidity	10–90% maximum relative humidity, noncondensing
Storage humidity	5–95% maximum relative humidity, noncondensing
Security encryption type	128-bit AES
MAC addresses	8 (active) / 16 (total): number of nodes that can be added to a single network
Bandwidth	500 Mbps
Compatibility	Not HomePlug v1.0 or HomePlug v1.0 Turbo compatible
Data transfer rate	Up to 500 Mbps with real throughput greater than 80 Mbps
Frequency band	2–75 Mbps
Modulation type	OFDM symbol modulation
Electromagnetic emissions	FCC Part 15 Class B; CE-EMC Class B; 3-home FCC Certificate
Safety agency approvals	UL Listed (UL 1950) /cUL IEC950; CE LVD; TUV CB, TUV CG

PL500P Technical Specifications

The PL500P meets the technical specifications defined in the following table.

Table 2. PL500P specifications

Feature	Specification
Data and routing protocols	IEEE 802.3 (10BASE-T), IEEE 802.3u (100BASE-Tx)
AC input	100–240V, 0.2A (max.)
Power consumption	Normal: 4W, power saving mode: <0.5W
Dimensions	67 x 55 x 34 mm (2.64 x 2.17 x 1.34 in.)
Weight	0.085kg (0.19 lb.)
Operating temperature	0° to 40°C (32º to 104ºF)
Operating humidity	10–90% maximum relative humidity, noncondensing
Storage humidity	5–95% maximum relative humidity, noncondensing
Security encryption type	128-bit AES
MAC addresses	8 (active) / 16 (total): number of nodes that can be added to a single network
Bandwidth	500 Mbps† Powerline AV interface
Compatibility	Not HomePlug v1.0 or HomePlug v1.0 Turbo compatible
Data transfer rate	Up to 500 Mbps with real throughput greater than 80 Mbps
Frequency band	2–75 Mbps
Modulation type	OFDM symbol modulation
Electromagnetic emissions	FCC Part 15 Class B; CE-EMC Class B; 3-home FCC Certificate
Safety agency approvals	UL Listed (UL 1950) /cUL IEC950; CE LVD; TUV CB, TUV CG

Safety Information

To ensure your own personal safety and to help protect your system from potential damage, follow these safety guidelines.

- AC input: 100–240V, 0.25A (max.)
- Operating temperature: 0–40 degrees C.
- Actual data throughput will vary. Network conditions and environmental factors, including volume of network traffic, building materials and construction, and network overhead, lower actual data throughput rate.
- Do not service any product except as explained in your system documentation.
- Opening or removing covers that are marked with the triangular symbol with a lightning bolt can expose you to electrical shock. Only a trained service technician should service components inside these compartments.
- Use the product only with approved equipment.
- Allow the product to cool before removing covers or touching internal components.
- To help avoid damaging your system, be sure that the voltage selection switch (if provided) on the power supply is set to match the power available at your location:
  - 110 volts (V), 60 hertz (Hz) in most of North and South America and some Far Eastern countries such as South Korea and Taiwan
  - 100V, 50 Hz in eastern Japan and 100V, 60 Hz in western Japan
  - 230V, 50 Hz in most of Europe, the Middle East, and the Far East
- The peripheral power cables are equipped with three-prong plugs to help ensure proper grounding. Do not use adapter plugs or remove the grounding prong from a cable.
- Observe extension cable and power strip ratings. Make sure that the total ampere rating of all products plugged into the extension cable or power strip does not exceed 80 percent of the ampere ratings limit for the extension cable or power strip.
- To help protect your system from sudden, transient increases and decreases in electrical power, use a surge suppressor, line conditioner, or uninterruptible power supply (UPS).
- For more safety instructions, see *Appendix B, Notification of Compliance*.

Notification of Compliance

Wired Powerline products

B

Safety Instructions and Precautions

WARNING:

Use the following safety guidelines to ensure your own personal safety and to help protect your product from potential damage. To reduce the risk of bodily injury, electrical shock, fire, and damage to the equipment, observe the following precautions.

- The socket-outlet shall be installed near the equipment and shall be easily accessible.
- Observe and follow service markings.
- If any of the following conditions occur, unplug the product from the electrical outlet and replace the part or contact your service provider/retailer:
  - The power cable, extension cable, or plug is damaged.
  - An object has fallen into the product.
  - The product has been exposed to water.
  - The product has been dropped or damaged.
  - The product does not operate correctly when you follow the operating instructions.
- Keep your system away from radiators and heat sources. Also, do not block cooling vents.
- Do not spill food or liquids on your system components, and never operate the product in a wet environment.
- Do not push any objects into the openings of your system. Doing so can cause fire or electric shock by shorting out interior components.
- Operate the product only from the type of external power source indicated on the electrical ratings label.
- Be sure that attached devices are electrically rated to operate with the power available in your location.
- Use only approved power cables. If you have not been provided with a power cable for your system or for any AC-powered option intended for your system, purchase a power cable that is approved for use in your country. The power cable must be rated for the product and for the voltage and current marked on the product's electrical ratings label.

The voltage and current rating of the cable should be greater than the ratings marked on the product.

- To help prevent electric shock, plug the system and peripheral power cables into properly grounded electrical outlets.
- Do not use adapter plugs. If you must use an extension cable, use a three-wire cable with properly grounded plugs.
- Observe extension cable and power strip ratings. Make sure that the total ampere rating for all products plugged into the extension cable or power strip does not exceed 80 percent of the ampere ratings limit for the extension cable or power strip.
- To help protect your system from sudden, transient increases and decreases in electrical power, use a surge suppressor, line conditioner, or uninterruptible power supply (UPS).
- Position system cables and power cables carefully; route cables so that they cannot be stepped on or tripped over. Be sure that nothing rests on any cables.
- Do not modify power cables or plugs.
- Always follow your local and national wiring rules.

Regulatory Compliance Information

This section includes user requirements for operating this product in accordance with National laws for usage of radio spectrum and operation of radio devices. Failure of the end-user to comply with the applicable requirements may result in unlawful operation and adverse action against the end-user by the applicable National regulatory authority.

This product's firmware limits operation to only the channels allowed in a particular Region or Country. Therefore, all options described in this user's guide may not be available in your version of the product.

Europe – EU Declaration of Conformity

Products bearing the CE marking comply with the following EU directives:

- EMC Directive 2004/108/EC
- Low Voltage Directive 2006/95/EC

If this product has telecommunications functionality, it also complies with the requirements of the following EU Directive:

- R&TTE Directive 1999/5/EC

Compliance with these directives implies conformity to harmonized European standards that are noted in the EU Declaration of Conformity.

FCC Requirements for Operation in the United States

FCC Information to User

This product does not contain any user serviceable components and is to be used with approved antennas only. Any product changes or modifications will invalidate all applicable regulatory certifications and approvals

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

FCC Guidelines for Human Exposure

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance of 20 cm between the radiator and your body.

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

FCC Declaration of Conformity

We, On Networks, 6455 East Johns Crossing, Suite 230, Duluth, GA 30097, declare under our sole responsibility that the Product Name™/® & Model complies with Part 15 of FCC Rules. Operation is subject to the following two conditions:

- This device may not cause harmful interference, and
- This device must accept any interference received, including interference that may cause undesired operation.

FCC Radio Frequency Interference Warnings & Instructions

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following methods:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and the receiver.
- Connect the equipment into an electrical outlet on a circuit different from that which the radio receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Modifications made to the product, unless expressly approved by On Networks, could void the user’s right to operate the equipment.

Canadian Department of Communications Radio Interference Regulations

This digital apparatus, the Powerline PL500 Series Adapter, does not exceed the Class B limits for radio-noise emissions from digital apparatus as set out in the Radio Interference Regulations of the Canadian Department of Communications.

This Class [B] digital apparatus complies with Canadian ICES-003.
Cet appareil numérique de la classe [B] est conforme à la norme NMB-003 du Canada.